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Beth Pearson-Naul

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF: Viswanathan, Raman	§	Group Art Unit: 2635
	§	Confirmation No. 6331
Serial No.: 09/586,130	§	
Filed: June 2, 2000	§	Examiner: Hung Q. Dang
Title: "Improved Wireline Data Transmission System and Method	§	Atty. Docket: 664-23196-US

DECLARATION OF RAMAN VISWANATHAN UNDER 37 C.F.R. 1.132

I. The undersigned, being hereby warned that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001, and that such willful false statements may jeopardize the validity of the application or any resulting patent, declares all statements made of his own knowledge are true and all statements made on information and belief are believed to be true.

II. My name is Raman Viswanathan. I am a Staff Engineer employed by the Baker Atlas Division of Baker Hughes Incorporated. I have been an employee of Baker Atlas or of its

predecessor company, Western Atlas Logging Services Division of Western Atlas International Inc. ("WAII") since the formation of WAII in 1987 as a combination of Western Geophysical Company and the Dresser Atlas Division of Dresser Industries, Inc. From 1972 to 1987, I was employed by Dresser Atlas. In my current assignment, I am responsible for developing improved methods of communication in oilfield logging applications.

III. From 1965 to 1966 I was a trainee at the Institut National des Sciences Appliquées in Villeurbanne, France in the field of optics. From 1966-1969 I was a research fellow at the Defense Research Laboratory, Hyderabad India.

IV. I earned my B.S. in Electrical Engineering from Osmania University, Hyderabad, India in 1964. I was awarded the degree of M.S.E.E. from Oklahoma University, Norman, Oklahoma, in 1972.

V. I am an inventor on US patents 4,346,593 and 4,556,884

VI. United States Patent Application Serial No:09/586,130 ("the Present Invention") deals with improving bandwidth in wireline data transmission. U.S. Patent No: 5,148,408 to *Matthews* teaches a drilling system and a method of transmitting acoustic signals in a drill string. U.S. Patent No: 4,777,324 to *Lee* teaches an audio cable configured to separate an applied audio frequency to have low frequencies (0-300 hertz) transmitted via the central conductor, mid-range frequencies (300-700 hertz) on the six conductors, and frequencies above 700 hertz transmitted

on the outer bundles. There is no mention of applicability or usefulness in a well logging cable. And U.S. Patent No: 3,259,675 to *Bowers* teaches a multiconductor armored wireline cable and does not teach or suggest the use of twisted pair conductors as an option for replacing any of the conductors in the cable.

VII. The wireline logging environment requires cables and conductors to withstand high pressure, extreme tensile loading and to maintain data rate over long vertical distances. Twisted pair communications cables have been known in surface communications for some time. The cable of the present invention, however, introduces the twisted-pair conductor to an environment not contemplated in surface communication systems.

VIII. One of the novel features of the present invention is in the use of at least one twisted-pair of signal conductors in a load-bearing retrievable wireline cable experiencing the unique environment of an underground well. The invention is not simply directed to improving cable bandwidth in a general sense, but improving bandwidth in a particular application-specific cable, i.e., a wireline well logging cable.

IX. Well logging cables have been produced in standard configurations for many years. Standard armored cables include either a single conductor or multiple conductors. A single conductor armored cable typically includes a single insulated conductor as a core, and a protective conductive sheathing surrounds the insulated core. The core and sheathing form an electrical circuit path for transmitting electrical power and data. The standard multi-conductor

armored cable is a 7-conductor armored cable used for multiple channel tools. Such so called single conductor wireline cables, or similarly constructed multi-conductor cables, are almost exclusively used to operate downhole electrical devices because of a variety of reasons associated with the space limited and rigorous environment of a borehole.

X. Those with skill in the art have recognized bandwidth limitations of the standard cables, and have addressed the problem by the use of coaxial cable configurations. A common coaxial cable must utilize a shielding as a return for power and data. In some countries, such as Norway for example, regulations prohibiting the use of the shield as a common return for both power and data make the well-known coaxial cable unacceptable. Others have addressed the issue of increasing bandwidth in wireline cables by introducing another coaxial cable having a center conductor for applying power and data, an inner shield for data return and then an outer shield for power return. While this configuration, sometimes called a triaxial configuration, meets government regulations the cable capacitance remains within the 40-60 pF range.

XI. I conceived of the twisted pair wireline cable with the expectation that bandwidth would be improved over the standard wireline configurations while allowing the same general use and size requirements to remain relatively consistent with standard cables. I did not expect, however, the bandwidth to be as improved as later tests proved. That is because a standard cable having a center conductor and several outer conductors utilizes a helical wrap of the outer conductors. Thus, the center conductor and any one outer conductor resembles a twisted pair of conductors. I expected some improvement in replacing the standard configuration with actual twisted-pair

conductors, because the twisted-pair conductors provide better symmetry for cancelling out electromagnetic fields. I simulated and tested the bandwidth of several cables and cable lengths, where the cables utilized twisted wire pairs according to my invention. The results showed an improved cable capacitance of about 9.1 pF/ft as compared to 40-60 pF/ft in the standard multi-conductor cable and the coaxial cable. Cables constructed according to my invention have bandwidth capability to at least 350 kHz, which is almost 3-times the bandwidth of the standard cable used in wireline applications as well as coaxial and triaxial cables introduced in attempt to improve cable bandwidth.

XII. Therefore, others in the industry have addressed the problem of increasing the bandwidth in wireline cables by utilizing coaxial cables without gaining the high bandwidth as I found with the twisted-pair design of the present invention. Moreover, there is no suggestion in the prior art to combine the twisted-pair audio cable of *Lee* with the standard wireline cable configurations as taught by *Bowers*. And the result of doing so according to the present invention has proved to be unexpectedly high bandwidth for data transmission.

Respectfully submitted,

R Viswanathan

Dated: July 1, 2003

Raman Viswanathan